

Exotic nuclei for Physics (AGATA), Astrophysics (Helios), and Applications (ClimOcean)

Quantal rotation, nuclear astrophysics with solenoids and other paraphernalia

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Nuclear physics research is at the dawn of a new era. After the Big Bang and billions years of evolution, the universe has provided us around 2000 nuclei. Based on the information from these nuclei, nuclear theory has been established in order to understand the structure of the nucleus. The steady progress over the past twenty years in the development of high intensity stable beams and of beams of radioactive isotopes has allowed to vastly expand the objectives of experimental nuclear research. It is also becoming possible to study in the laboratory a range of nuclear reactions that take place in exploding stars providing crucial information to understand how the chemical elements that we find on Earth were formed. With more than 2000 nuclei produced artificially and around 6000 expected to be produced in the facilities in operation or under construction in China, Europe, Japan and US, the conventional nuclear theory meet serious challenges. For example, the disappearance and appearance of the magic number is presently leading to the re-examination of the shell model and also of the path of the nucleosynthesis in Universe. To achieve this ambitious goal one needs to study the characteristics of unstable (radioactive) nuclei through their decays and the various nuclear interactions. Such unstable nuclei have also a wide range of applications (medicine, climate changes etc.).

In this presentation I will discuss recent results of the AGATA experimental campaign presently ongoing at LNL, together with the future program at the SPES ISOL radioactive ion beam facility including nuclear astrophysics with solenoidal spectrometers (we have recently performed experiments at the ISS (Isolde) and HELIOS (ANL)) and applications focused on monitoring the adaptation of marine species to climate changes (IFIC – Valencia (E) and LNL- UniPD (I)).